# Energy Use and Renewable Energy Sources

## Background

Our quality of life and economy depend on the availability of large amounts of energy, most of which comes from the combustion of fossil fuels. Fossil fuels are not renewable, which means that at some point they will become depleted and increasingly costly.[1] Also, their combustion releases air pollutants, including ozone precursors such as nitrogen oxides ($NO_x$) and volatile organic chemicals (VOCs); acid rain precursors including $NO_x$ and sulfur dioxide ($SO_2$); various toxics such as mercury; and carbon dioxide, a major greenhouse gas. Extraction, transport, refining and use of fossil fuels also cause serious environmental impacts to the earth's surface (e.g. strip mines, oil spills and storage tank leaks) and pollution of aquatic systems (e.g. acid mine drainage and thermal pollution of rivers). Large amounts of land and other resources are consumed for electricity transmission lines, oil and gas pipelines, road and rail transport of fuels, and fuels storage.

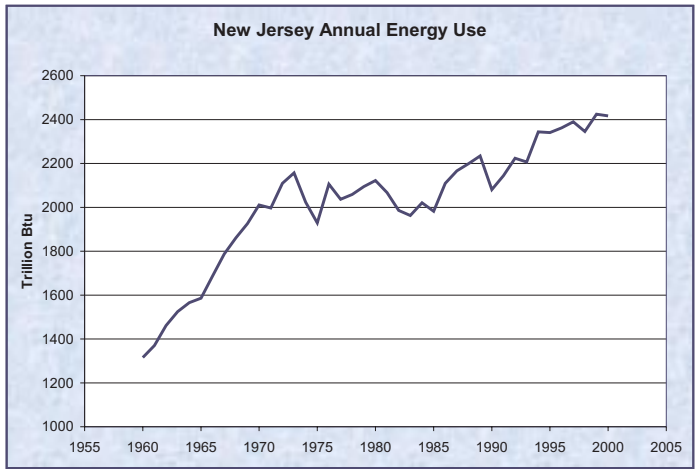
Unlike fossil fuel combustion, renewable energy sources provide energy without depleting fossil fuel reserves and with much lower overall carbon dioxide emissions. Renewable energy sources include hydropower, wave or tidal, geothermal, solar, wind and biomass. Biomass, including wood and plant-derived fuels such as biodiesel and ethanol, are burned to produce energy. Although these fuel sources release carbon dioxide when burned, generally they are not considered net releasers because they also remove carbon from the atmosphere during their growth cycle.[2] A fast-growing and relatively promising renewable source of energy in the U.S. is wind power. New wind-power sources are generally competitive in cost with new, conventional electricity-generating plants when sited in areas with a good wind resource. There are concerns about the adverse affects of wind energy on wildlife and tourism, however, and more research is needed. New Jersey Acting Governor Richard Codey has signed a moratorium on windmills off the New Jersey coast while the state drafts a policy.

## Status and Trends

Total energy use has grown steadily in New Jersey and the United States for the last several generations. (See "New Jersey Annual Energy Use"). However, there also has been a consistent trend of increased energy efficiency over time. (See "New Jersey Energy Use per Dollar of Gross State Product." )Because of increased energy efficiency, energy use per person has leveled off in recent years, as shown in the figure "New Jersey Annual Energy Use per Person."

There have been changes in the percentage of energy sources used, including a decline in the use of residual fuel oil and an increase in the use of nuclear power. Also, in recent years New Jersey has generated less electricity in-state, instead importing more from out-of-state sources. (See "NJ Energy Consumption, by Type of Fuel").

Production of energy by the combustion of fossil fuels releases carbon dioxide, a greenhouse gas whose presence in the atmosphere has a warming effect on the earth's climate. Globally, carbon dioxide is increasing steadily in the atmosphere, as are several other greenhouse gases. Evidence is strong that greenhouse gases generated by human activities already have altered the earth's climate, and are likely to cause significant warming in the future. Implications of this warming, and associated climate changes, are unclear, but impacts could be quite negative and essentially irreversible.

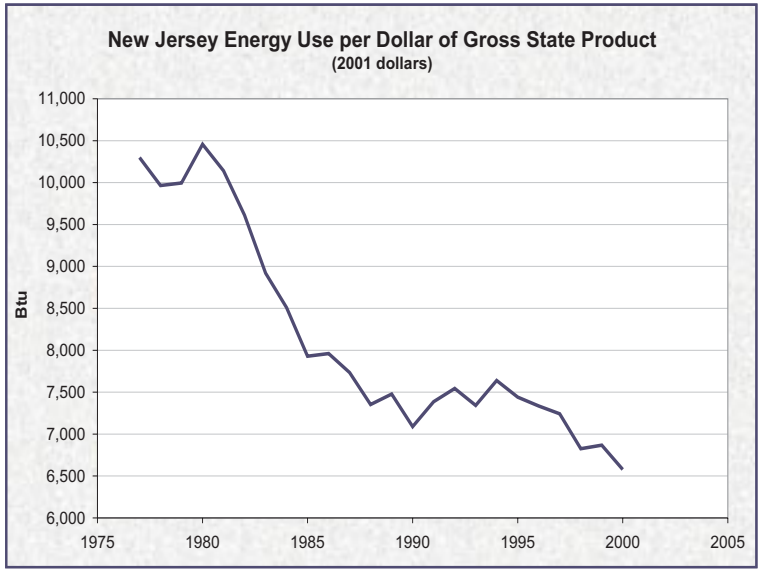


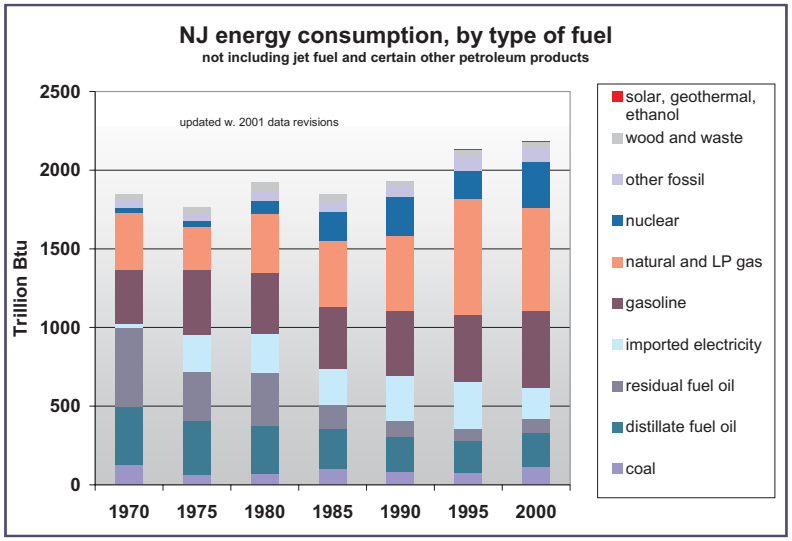

Despite efforts to implement strategies to reduce greenhouse gas emissions in the state, they continued to increase during the last decade, and seem likely to

remain on that path unless more aggressive control measures are instituted. (See the separate report, Greenhouse Gas Emissions, in this Environmental Trends series.)

Continued dependency on fossil fuels also means facing the risk of dramatically increasing energy costs if fossil fuel production fails to keep pace with the steadily growing demand for energy - or actually decreases, as some predict.[3,4]

Solutions to both problems can be found in increased energy efficiency and conservation, and in the replacement of fossil fuel energy with renewable sources. New Jersey lags behind the U.S. in use of renewable energy. Nationally, renewable energy supplies about 600 trillion Btu per year. New Jersey accounts for about 3.5 percent of the nation's energy use, and so might be expected to account for about 3.5 percent of the nation's renewable energy use as well. However, the state accounts for only about 1.8 trillion Btu of the nation's 600 trillion Btu from renewable sources, about 0.3 percent.



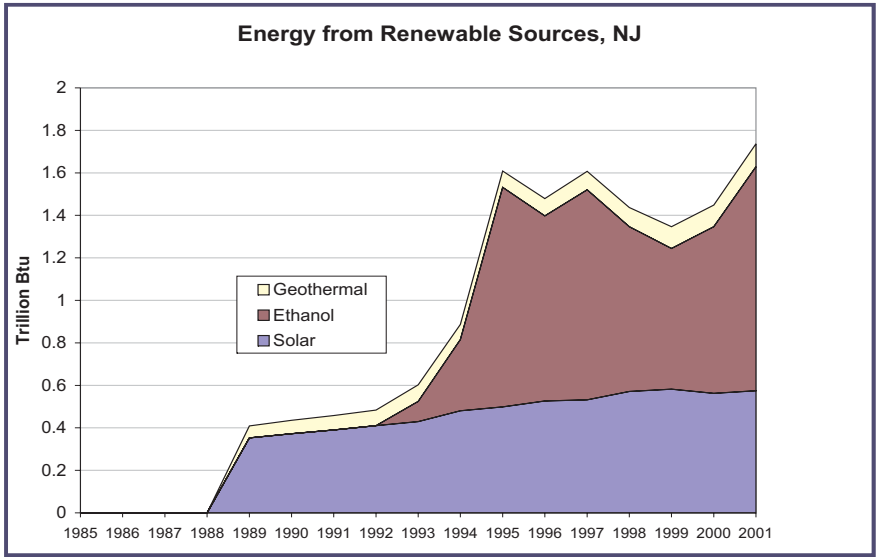




## *Outlook and Implications*

Between 1988 and 2001, New Jersey's use of renewable energy grew from essentially nothing to about 1.8 trillion Btu per year. See the figure "Energy from Renewable Sources, NJ." This corresponds to a growth rate of approximately 0.14 trillion Btu per year. Currently the State uses about 2400 trillion Btu per year, so renewable sources now contribute about 0.005% of the State's energy supply. (Note that renewable sources' contribution is still too small to even show in the chart "NJ Energy Consumption, by Type of Fuel.")

Since 1985, growth in energy use in New Jersey has averaged about 25 trillion Btu per year. The rate of growth in renewable energy will have to be over 100 times larger than today if renewable energy sources are to even keep pace with growth in energy demand. Growth will have to be larger still if renewable sources are to replace current fossil and nuclear sources. Unless New Jersey can dramatically increase the pace of introduction of renewable energy sources, or make great improvements in energy efficiency and conservation, or both, it is likely that the state will remain largely

dependent on fossil fuels. Without increased renewable sources and energy efficiency, it also appears likely that greenhouse gas emissions will increase.




The State could find ways to encourage further development of renewable sources, and also to promote additional energy conservation. Another option that could be considered is increased use of nuclear power, or, at least, maintenance of current capacity. Approximately 50% of the electricity generated in New Jersey is produced by nuclear power.

New Jersey has several initiatives that promote energy conservation and renewable energy. These initiatives include the following:

- A consent agreement between the state and PSEG Fossil LLC to reduce overall emissions rate of carbon dioxide per megawatt hour by 15 percent below 1990 levels by the end of 2005.
- The passage of the 1999 New Jersey Electric Discount and Energy Competition Act gives utility customers the opportunity to choose their electricity suppliers. As a result, energy companies that provide electricity from renewable sources have entered the New Jersey market and are offering consumers green energy choices.
- NJ Clean Energy Program, a ratepayer-funded program, encourages installation of energy-efficient and renewable electricity generation technologies.[1]
- Renewable Portfolio Standard (RPS), which is a requirement for electricity providers to provide 6.5 percent of electricity from class I and II renewables[2] by 2008.
- State government must purchase 12 percent Green-e certified electricity, or electricity generated from renewable energy.
- Emissions reductions by several NJ industrial facilities is required according to corporate covenants and the EPA Energy Star Program.[3]
- The promotion of sustainability initiatives by DEP to further increase renewable energy consumption.

Additional efforts are under consideration, including implementation of a cap-and-trade program developed through the Northeastern States' Regional Greenhouse Gas Initiative (RGGI) that would include, at a minimum, a cap on emissions by electricity producers in the region. A more accurate method of tracking emissions from power plants also is being developed and is expected to be up and running by July 2005.

So far, it is likely that these initiatives have reduced the use of fossil fuel energy from what it otherwise would have been, although they have not yet led to an absolute reduction in either greenhouse gas emissions or fossil fuel-derived energy use. Nevertheless, accomplishments to date should be noted. For example, anticipated energy savings from measures installed in 2003, with the support of the NJ Clean Energy Program, are 539,114,000 kWh of electricity and 10,465,620 Therms of natural gas. These installations translate to 202,308 metric tons of anticipated $CO_2$ emission savings in 2003. Another accomplishment is the increasing presence of LEED™ registered building projects in the state.[4] Because these new buildings are based on use of renewable energies, they likely are more energy efficient than conventional buildings.

## More Information

The Department's Bureau of Sustainable Communities and Innovative Technologies, within the Division of Science, Research, and Technology, continues to develop and refine a number of approaches to increase energy conservation, encourage renewable sources and cut greenhouse gas emissions. For more information, visit www.state.nj.us/dep/dsr/bscit.htm. Also, the New Jersey Board of Public Utilities, www.njcleanenergy.com/index.html, is active in promoting renewable sources and energy conservation.

## References


[1] Smil, Vaclav, 2003, Energy at the Crossroads: Global Perspectives and Uncertainties, MIT Press, Cambridge, MA

[2] However, the degree to which biomass fuels release no net carbon dioxide depends on the percentage of the carbon they contain that is from plants, and on the amount of fossil fuels used in the production, harvesting, and transport of these plant-derived materials. Municipal solid waste, for example, derives a significant portion of its heating value from plastics, which are produced from petroleum, a fossil substance. Ethanol is produced from corn or sugar cane, but these crops as currently grown require large inputs of fossil fuels such as diesel fuel for tractors and chemicals such as pesticides derived from petroleum.

[3] Goodstein, David, 2004, Out of Gas: The End of the Age of Oil, W.W. Norton, NY

[4] Deffeyes, Kenneth, 2003, Hubbert's Peak: The Impending World Oil Shortage, Princeton University Press, Princeton, NJ.

[5] Renewable energy, e.g. wind, solar, and hydro power, is considered to emit essentially zero $CO_2$

[6] Class I renewables are solar, wind, fuel cells powered by renewable fuels, geothermal, wave or tidal, and sustainable biomass

[7] Over the period 1990 to 2001, several energy efficiency, fuel switching, recycling, and pollution prevention projects by DuPont Chambers Works, Johnson & Johnson, L'Oreal USA Clark Manufacturing, Lucent Technologies, Shering-Plough, and the Naval Air Station at Lakehurst have reduced $CO_2$ emissions by a total of 1.1 million tons over the lifetimes of the projects.

[8] The US Green Building Council (USGBC), in Washington, D.C., is a leading promoter of sustainable architecture. The USGBC created LEED™ (Leadership in Energy and Environmental Design) in 1998, which is a voluntary green building rating system establishing national criteria for sustainable buildings. LEED™ promotes several green-building initiatives. LEED™ provides a complete framework for assessing building performance and meeting sustainability goals in five categories, which include sustainable sites, water efficiency, energy and atmosphere, materials and resources, environmental quality, and innovation and design process. The energy and atmosphere component is weighted relatively heavily in the performance determination; LEED-registered buildings are likely to be significantly more energy-efficient and/or heated/cooled with renewable energy than other buildings.